Role of Upper Hybrid resonance and diffraction effects at Electron Cyclotron Heating in tokamaks

Vdovin V.L.

RRC Kurchatov Institute, Nuclear Fusion Institute
vdov@pike.pike.ru

Abstract

We present preliminary modelling results of basic Electron Cyclotron Heating scenarios in tokamaks performed with newly developed 3D full wave STELEC (stellarator_ECH, tokamaks included as particular case) code. Code includes all basic wave physics as interference, diffraction, wave tunnelling, mode conversion at Upper Hybrid resonance to electron Bernstein waves and appropriate boundary conditions. Code operates in real 3D magnetic geometry and uses massive parallel terabyte computers and firstly permitted solution of above problem. Modelled are fundamental and second harmonics O-mode and X-mode scenarios in
T-10, DIII-D, FTU, JT-60U tokamaks and in ITER at fundamental harmonic. The Upper Hybrid resonance plays important role, leading to strong broadening of power deposition profiles at fundamental at O-mode RF power launch. This is partly supported by experiments on DIII-D, T-10 JT-60U and WEGA stellarator. Diffraction effects are investigated at second harmonic and these are shown to be important even at moderate plasma densities. Code discovered important new effect of remarkable RF power reflection on second harmonic resonance layer in poloidally oblique EC power launch scenarios, intended to be used for NTM suppression. The O-X-B scheme for over dense plasma is also explored.
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